

forms the base of the islands. It is somewhat remarkable that we meet on every side evidence of upheaval in the Pacific, where the general impression is that subsidence is taking place. The coral reef or subsidence theory of Darwin seem to have been too universally applied, and if it be the true explanation of the atoll, barrier reefs, &c., the causes at work may be much more limited and local than we are now inclined to think.

ON THE CLUPEIDÆ OF AUSTRALIA.

BY WILLIAM MACLEAY, F.L.S., &c.

Herrings are so very rarely seen in the Sydney Fish Market, that it is generally believed that the Australian Seas are barren of this valuable group of Fishes, which form as we know a large source of wealth in other countries.

It will scarcely be credited by many, that the very reverse is the case. There is no sea on the Globe, I believe, favoured with a more rich or varied supply of Fishes of the Herring tribe, than that which washes our shores.

That they are seldom seen is due to the facts, that the shoals do not as a rule enter the harbours on the coast, and that to fish for them in the open sea would require appliances not at present in the possession of our fishermen.

Our species, as might be expected, are different from those of the Northern Hemisphere, but in excellence as edibles certainly not inferior.

In giving, as I propose to do in this paper, a succinct account of all the species of *Clupeidæ* known at present to inhabit Australian waters, with all that I have been able to ascertain of their habits, haunts, and uses, I think it is desirable that I should facilitate as much as possible the difficulties in the way of local observers, arising from their not having ready access to

some of the authorities referred to for the descriptions of the genera and species. I have, therefore, in addition to giving a short synopsis of the generic characters, quoted in full the description of each species, with the name of the authority, excepting in instances where the descriptions or information have been previously published in the Proceedings of our own Society.

The *Clupeidæ* may be briefly characterised as—Physostomous scaly Fishes, with naked head and no barbels, abdomen more or less compressed or serrated, no adipose fin, dorsal fin short, anal sometimes long, dentition feeble.

SYNOPSIS OF THE AUSTRALIAN GENERA.

ENGRAULIS.—Body compressed, mouth very wide, lateral; upper jaw projecting. Species—*Engraulis Antarcticus*, *E. nasutus*.

CHATOËSSUS.—Mouth transverse, inferior, narrow, without teeth upper jaw overlapping the lower, abdomen serrated. Species—*Chatoëssus Erebi*, *C. Richardsoni*.

BRISBANIA.—Mouth wide, opening upwards, maxillary large, teeth small and numerous, last ray of dorsal fin elongate, abdomen not serrated. Species—*Brisbania Staigeri*.

CLUPEA.—Mouth small, teeth minute or none, abdomen serrated, anal fin short. Species—*Clupea sagax*, *C. Sundaica*, *C. hipselosoma*, *C. moluccensis*, *C. tembang*, *C. Novæ-Hollandiæ*, *C. vittata*, *C. Richmondia*, *C. Schlegellii*.

SPRATELLOIDES.—Mouth anterior and lateral, abdomen not keeled, dorsal fin opposite to ventrals, teeth none. Species—*Spratelloides delicatulus*.

ETRUMEUS.—Mouth anterior and lateral, abdomen not keeled, dorsal fin entirely in advance of ventrals. Species—*Etrumeus Jacksoniensis*.

ELOPS.—Upper jaw shorter than lower, abdomen rounded, an osseous gular plate, scales small. Species—*Elops saurus*.

MEGALOPS.—Upper jaw shorter than lower, abdomen rounded, an osseous gular plate, scales large. Species—*Megalops cyprinoides*.

CHANOS.—Mouth small, toothless, abdomen flat, gill membranes entirely united, scales small. Species—*Chanos salmoneus*.

I shall now proceed to give a detailed account of each species in the order in which I have placed them in the above synopsis.

1. ENGRAULIS ANTARCTICUS, Casteln.

Proc. Zool. and Acclim. Soc. Victoria, Vol. 1, p. 186.

There is little doubt, I think, that this is identical with the Fish mentioned by Gunther, Cat. Vol. 7, p. 386, as coming from Tasmania, and which he makes out to be merely a variety of *Engraulis enerasicholus*, the well known anchovy of Europe. Dr. Gunther gives his variety a name (*antipodum*), which looks very much like a belief in its specific character. Count Castlenau gives the following description of this Fish in the volume cited:—
 “The height of body seven and one-quarter times in the total length; head, four and one-quarter in the same; eye, three and one-fifth in length of head; the muzzle considerably longer than the mandibula and embracing it, the upper jaw presents a line of very minute and equal teeth, and the lower one has a similar line of still smaller ones. The dorsal fin is placed at an equal distance from the snout and the base of the caudal; it is as high as the body, and of fifteen rays—the first much shorter than the others, and the second and fifth rather longer than the following; caudal fin strongly bifurcated, the lateral rays being about one-third longer than the height of the body; it is formed of twenty long rays, and five or six shorter ones on each side; anal fin rather lower than the dorsal, having twelve rays of which the first is short. From the posterior end of the anal the distance to the lateral root of the caudal is contained three times in the distance from its beginning to the end of the mandibula, and twice from the superior root of the caudal to the anterior

one of the dorsal; the ventrals are rather smaller than the pectorals, are formed of only one simple ray, and five branched ones, and are placed a little in advance of the dorsal; the pectorals are formed of fifteen rays."

"The colour of the upper parts is of a light greyish green with purple tinges; the head is brown, the lower parts are very silvery; there is a narrow, yellow, longitudinal streak from the upper part of the operculum to the base of the caudal, and below this extends a broad, longitudinal, silvery, and very brilliant band, having sometimes a blue tinge; the operculum and throat are very iridescent; the fins are diaphanous; the tail is yellow at its base, and obscure towards the extremity; eye, silvery. After preservation in spirits the Fish appears very silvery, with the upper parts of a dark blue."

Count Castlenau also states that it is very common in the Melbourne market throughout the year, and that it is known to the fishermen by the name of "white bait."

This Fish is alluded to by both Mr. Hutton and Dr. Hector as a New Zealand species, but they do not seem themselves to have seen it, and they mention it (following Dr. Gunther) as a variety of the European species, a supposition which Count Castlenau has shown to be erroneous.

I have never seen this Fish or indeed any species of *Engraulis* in Sydney, nor is sufficient information procurable from Melbourne, where it is said to be so common, to enable me to ascertain whether in point of excellence it at all equals its congener, the Anchovy of the Mediterranean. But there is one fact connected with its little known history, which while it proves if correct its specific difference from the European species, may also be taken as an indication of its inferior value in an economic sense, it is the assertion that it is plentiful at Melbourne at all seasons of the year.

Those species only of the Herring tribe which are gregarious and periodic in their visits, such as the Herring, the Pilchard, the

Sardine, and the Anchovy in Europe, can be looked upon as large sources of national wealth, and if this habit does not belong to the Melbourne Anchovy, it is probable that its fishing may never become a matter of much importance. It is desirable, however, that the history of the Fish should be ascertained. I think it is not unlikely that the specimens seen so frequently in the Melbourne Market may be young Fish, (the name "white bait" seems to indicate so much,) and that the periodical haunts of the large shoals have never yet been noticed.

2. *ENGRAULIS NASUTUS*. Casteln.

Proc. Linn. Soc., N. S. Wales, Vol. III., p. 51.

This species is described by Count Castlenau (loc. cit.) from one adult specimen, 7 inches long, sent to him from the Norman River, Gulf of Carpentaria. Its special distinguishing character seems to be a strong longitudinal ridge along the top of the head.

There is another species of *Engraulis*, said to have been observed on the northern coast of Australia, but on insufficient evidence, which I may here make mention of. It is the *Engraulis Russellii*, *indicus*, and *balinensis*, of the late Dr. Bleeker; *indicus* being the name given by him in his last work—"Atlas Ichthyologique.") the *Engraulis Brownii*, *Gm.*, of Dr. Cantor, (Cat. of Malayan Fishes, page 303) and the *Engraulis Russellii* of Dr. Gunther's Catalogue of Fishes. Dr. Bleeker places the species in the genus *Stolephorus*, which he separates from *Engraulis* on some very slight grounds. The fish is very common throughout the seas of the East Indian Archipelago, and forms a very large and valuable article of production and trade. Dr. Cantor in his Catalogue of Malayan Fishes page 305, gives the following interesting information respecting it:—"In the Straits of Malacca as in the mouth of the Ganges, this species is astoundingly numerous at all seasons, two or three inches is the usual length, five to six are very rarely seen. In fine weather swarms may be seen swimming near the water's edge, and making very short leaps closely above the surface of the sea. As Russell observes,

they are highly valued for their delicate flavour when fried. In Java, Sumatra, and the Straits of Malacca, large quantities are preserved both for home consumption and exportation to India and China. The delicious condiment is famed under the denomination of “*roode vischjes*” or “*Red Fish*” (*Ikan Merah* of the Malays) and is used as a relish. The following mode of preparation, as practised at Bencoolen and Malacca, has been communicated by W. J. Lewis Esq., Ass. Res. Counsellor, Penang. “After the heads have been removed, the Fishes (those of middling size are preferred,) are cleansed, salted (in the proportion of one to eight parts of Fish), and deposited in flat glazed earthen vessels. In the latter they are for three days submitted to pressure by means of stones placed on thin boards or dried plantain leaves. The Fishes are next freed from salt, and saturated with vinegar of Cocoa-palm toddy, after which are added powdered ginger and black pepper (the latter mostly entire), and some brandy and powdered “*Red Rice*.” After having been kept for three days, a little more vinegar is added before placing the fishes in well-closed jars or bottles. They should be kept four or five months before being used. The expense of a quart bottle of this condiment is about 30 cents, the selling price one Spanish dollar. “*Red Rice*” is the variety of *Oryza sativa*, called *glutinosa*, steeped in an infusion of Cochineal.”

This is the most important of the Anchovies of India and Malacca, but there are in these seas several other species all highly prized as food by the natives of the country.

3. CHATOËSSUS EREBI, Gunther.

Cat. Fish, Vol. 7, p. 407, *Chatoëssus come*, Richards, Voy. Ereb. and Ferrer, p. 62, pl. 38, fig. 7—10.

The following is Dr. Gunther's description of this species:—
“B. 5. D. 14. A. 21. L. lat. 45—49. L. transv. 17—21. The dorsal filament reaches to the end of the anal fin, or to the caudal. Scales not deciduous. The height of the body is contained twice and one-fifth in the total length (without caudal), the length of

the head four-times and one fourth. The diameter of the eye is more than the length of the snout, and two-ninths of that of the head. Snout projecting beyond the cleft of the mouth, which is nearly transverse. Origin of the dorsal fin nearer to the end of the snout than to the root of the caudal fin, and behind the base of the ventrals. Coloration uniform."

This species was at first accepted by Count Castelnau as identical with the species so well known in the Murray, Murrumbidgee, and all the rivers rising to the westward of the dividing range of Eastern Australia. Subsequent observations however, satisfied him that the Fish of the rivers of the interior was specifically distinct, and he has accordingly given it the name of *C. Richardsons*. The present species *C. Erebi*, he has seen from Western Australia, Dampier's Archipelago, the Norman and the Brisbane rivers, at the last of these places said to be known in the Market under the name of "*Sardine*." It is said also to be found in the Clarence, Burnett, and Fitzroy, where it is known as the Bony Bream. Whether all these localities are correct, or whether some of them do not apply to the other species mentioned below, is a matter I believe open to doubt. It seems from all that I can gather of its habits to be a fresh-water Fish, though sometimes found in the sea. As an article of food it is said to be much relished in some places. Count Castelnau states on the authority of Mr. Bostock of Swan River, that it is known there under the name of "*Perth Herring*," quantities being smoked with Banksia or sawdust, and sold in the fruit stores. It is not probable however, that it will ever become an important article of consumption, as it is evidently not gregarious in its habits.

4. CHATOËSSUS RICHARDSONI, Castelnau.

Proc. Zool. and Acclim. Soc., Victoria, Vol. 11, p. 144.

This species differs from the preceding according to Count Castelnau in being of a more convex and less elongate form, and

in having the last dorsal ray much shorter than in the other species, in fact little less than half the length. It is found in all the Western rivers which fall into the Murray. Count Castelnau states that it is much esteemed as food in the Melbourne Market and sells at a high price, the same author states that Blandowski enumerates it among the Fishes he found in the Murray River, that it is called by the natives "*Manur*", and adds that it "leaps frequently out of the water, and is easily caught by its elongated ray in thin fine nets, laid by the natives horizontally on the water. The Fish gets entangled in the twine and cannot escape. It is most numerous in the Darling, but is also found about and below the junction of the Murray and Darling Rivers. In June and July it is considered a delicacy by the natives, and forms their principal food during these two months. The young women are not permitted to eat them, from a belief that if they did, all the fishes in the river would die; but in reality, because it is thought to be an aphrodisiac, this Fish being very fat and nourishing. It is also placed on the tops of graves, to point out the direction in which he lives who caused the death of the inmate; therefore this Fish is much esteemed." My own experience, derived from many years residence on the Murrumbidgee does not by any means tally with Mr. Blandowski's, either as regards the excellence or miraculous qualities of this Fish. The name in the Wooradjerie language was "*Ka-ee-ra*," it was not common, was considered too bony to be of much value as food, and was certainly not regarded in a superstitious light. I never tasted it but once, and then I found that though the flavour was delicate enough, it was such a mass of bones as to make it useless as an article of food. The average size of the adult Fish is from ten to fourteen inches in length.

5. BRISBANIA STAIGERI, (Castelnau).

Proc. Linn. Soc., N.S. Wales, Vol. 2, p. 241, pl. 3.

This Fish is fully described and figured by Count Castelnau in the proceedings of our Society for 1877. It is found in the

upper part of the Brisbane River, and would appear to be far from common. Nothing is said of its qualities as a food fish. Its affinity seems to be more with *Megalops* than *Chatoëssus*.

6. CLUPEA SAGAX, (Jenyns).

Zool. Beagle, Fish, p. 134, Gunth., Cat., Vol. 7, p. 443.

Alosa melanosticta, Cuv. and Val., Vol. XX., p. 444.

This species which is almost identical with the English Pilchard is thus described by Dr. Gunther :—“The height of the body is one fifth of the total length (without caudal), the length of the head rather more than one-fourth. Lower jaw but slightly prominent; the maxillary extending nearly to the vertical from the middle of the eye. No teeth on the palate or on the tongue. Gill rakers very fine and long, closely set. Ventral fins inserted below the posterior half of the base of the dorsal. Origin of the dorsal fin nearer to the end of the snout than to the root of the caudal. Abdominal serrature very indistinct; there are about eleven abdominal scutes behind the base of the ventral fins. Operculum with very conspicuous radiating striæ, descending towards the suboperculum. Scales slightly and finely striated, the striæ being most conspicuous on the margin. The scales become very small towards the root of the caudal fin. A series of more or less distinct round blackish spots along the side.”

“Pacific Coasts of America; Japan; New Zealand.”

Count Castelnau (Proc. Zool. and Acclim. Soc. of Victoria, Vol. 1, p. 187.) points out that Dr. Gunther is right in his view that this species is identical with the *melanosticta* of Cuv. and Val. and is not the same, as stated by Professor M'Coy, as the *melanosticta* of Schlegel. He also quotes the following account given by Professor M'Coy of the appearance of this Fish in Port Phillip: “A specimen was first brought to me in August 1864, from a small shoal then seen for the first time in Hobson's Bay, and quite unknown to the fishermen. * * * In the same

month, in the succeeding year they appeared in great abundance in the Bay, and were caught by thousands for the market. After remaining for a few weeks they disappeared until the same time in 1866, when they arrived in such countless thousands, that carts were filled with them, by simply dipping them out of the sea with large baskets. Hundreds of tons were sent up the country to the inland markets, and through the city, for several weeks they were sold for a few pence the bucketful, while the captains of the ships entering the Bay reported having passed through closely packed shoals of them for miles." Professor M'Coy has, I should think, been misinformed as to the year 1864 being the first appearance of this fish in Victoria, I have seen it in Port Jackson years prior to that date, where it was known under the name of "Sardine," but it is not unlikely that though annually visiting our coasts, it may be an accidental occurrence, a portion of the shoal actually entering the harbours.

The usual time, as far as I can ascertain from the Fishermen, of its annual visit to the coast of New South Wales is in June and July, earlier it would appear than in Victoria, but it is not easy to fix the time within a few weeks. They are called by the Fishermen "*Maray*," probably a native name, but I find that the same name is sometimes used for other species of herring. The shoals are described as enormous, covering miles of sea, and accompanied by flights of birds and numbers of large fishes. These shoals are generally observed from one to three miles from the land, and are always proceeding in a *northerly* direction. The same fish is reported by Dr. Hector to visit the East Coast of Otago every year in February or March: "On the last occasion (probably 1871) it was observed that the shoal was migrating *southwards* and extended as far as the eye could reach, followed by multitudes of gulls, mutton birds, barracoota, and porpoises. So densely packed were they that by dipping a pitcher in the sea it would contain half fish, so that if larger boats and suitable nets were employed thousands of tons could be caught."

There is much that is curious about the migrations of this fish. All the shoals which pass here in winter are going north, the shoals visiting Otago in summer are moving south. Are they the same fishes returning to their homes in the Antarctic Seas after months of travel in search of spawning grounds? If so, how far north do they go? and where are their breeding grounds?

The species appears to be unknown in the warm seas of the north of Australia. Dr. Bleeker makes no mention of it in his elaborate works on the Fishes of the East Indian Archipelago; Dr. Cantor does not mention it in his "Fishes of Malacca," and I never came across a specimen of it during my fishing excursion in the "Chevert" along the North-Eastern Coast of Australia, Torres Straits, and the South Coast of New Guinea. It must be born in mind however, that it is found in California, Japan, and other temperate regions north of the Equator, so that it is not by any means certain that it may not penetrate into the tropical regions of the Pacific. But, if so, it is most probable that the course taken is outside the great Barrier Reef.

7. CLUPEA SUNDAICA. Bleek.

Atlas Ichthyol. Clup., p. 105, Pl. 271, fig. 5.

Clupea fimbriata, Bleek., not of Valenciennes.

The following is a translation of Dr. Bleeker's description of this Fish:—

"Body, oblong, compressed; height, 3 to $3\frac{1}{2}$ times in the length without, and $3\frac{3}{4}$ to 4 and one-fifth with, the caudal fin; the width of the body $2\frac{1}{3}$ to 3 in its height; head, 4 to $4\frac{1}{2}$ in the length of the body without the caudal fin, and 5 to $5\frac{1}{2}$ with it, considerably shorter than the height of the body, as high as its length, and its width 2 to $2\frac{1}{2}$ in its length; on each side of the vertex a number of somewhat diverging striæ extending backwards; the diameter of the eyes 3 to $3\frac{1}{2}$ in the length of the head, and from two-thirds to three-fifths of their diameter

apart, the palpebral membrane broader in front than behind, and in part covering the pupil; upper maxilla without teeth, and reaching to the vertical from the anterior margin of the eye and about $2\frac{1}{2}$ in the length of the head; the lower jaw scarcely prominent, the symphysis with denticles more readily felt than seen; no pterygoid teeth, those on the palate disposed in a long row, and on the tongue in a median line; præoperculum obtusely rounded; operculum smooth, scarcely striated in the middle, in height more than double the breadth, with the inferior margin straight; the ventral outline conspicuously more convex than the dorsal; the scales generally transversely striated on the basal part, and longitudinally on the free part, and crenate-fimbriate, numbering about 45 in a longitudinal series from the upper angle of the branchial aperture to the base of the caudal fin, and 11 or 12 in a transverse series under the dorsal fin; belly very knife-shaped and serrated with about 30 spines, becoming less conspicuous with age; the dorsal fin situated about half-way between the apex of the rostrum and the base of the tail, and its middle third opposite the insertion of the ventrals, it is acute, emarginate, and about half the height of the body, with a scaly sheath at its base; pectorals, acute, about the length of the head without the snout; ventrals, acute, about half the length of the pectorals; anal fin much shorter than the head, low, not much higher in front than behind, slightly emarginate and scaly at the base; caudal fin scaly at the base, profoundly bilobed, the lobes equal and 4 and $\frac{3}{5}$ to 5 times in the length of the body; colour, on the back bluish green, the sides and under surface silvery, rostrum brownish, iris yellow, a broad longitudinal golden fascia along the upper part of each side, fins hyaline or yellow, dorsal fin above, and caudal behind, margined with brown, a small black or blue mark at the anterior base of the dorsal fin."

This species can be readily distinguished by an ordinary observer, from *Clupea sagax*, by its much deeper and more

compressed body, its deciduous scales, and the bright golden vitta on each side near the back. It is about seven inches in length. My first acquaintance with it was about three weeks ago, when a shoal seems to have visited the harbour, and I found one morning the beach at Elizabeth Bay strewed with bushels of them, left by a fisherman who had hauled his seine there during the night, and taken away I believe as many as he conveniently could. I find however, that it is a fish well known to the fishermen, called by them "*herring*," and sometimes "*Maray*," though that name more properly belongs to *Clupea sagax*. Like that species also, it visits our coasts in winter in enormous shoals, and also always travelling in a northerly direction. It seems probable, however, from what the fishermen tell me, that its breeding grounds are not far distant, as some of them are to be found in the Hawkesbury, about Mullet Island, at all seasons of the year, and the young fry of apparently the same species are sometimes very abundant there. Dr. Bleeker gives Java and Celebes as localities in which this fish is found, sometimes, he says, they are caught in great numbers, and form a very important part of the food of the population of these countries. I can myself vouch for the excellence and delicacy of flavour of these beautiful fishes. I look upon them as far superior to the common herring of Scotland as an article of food, and I verily believe that preserved in oil in the manner of sardines, they would eclipse even these delicacies.

8. *CLUPEA HYPELOSOMA*, Bleek.

Atlas Ichthyol. Clup. p. 104, Pl. 267, fig. 2. Gunth. Cat. Fish.
Vol. 7, p. 431.

This species is very like the last. It is proportionally deeper, the maxillary bone seems to extend back under the eye further than in the other, and there is no golden band along the upper part of each side. I subjoin the specific characters given by Dr. Gunther, Dr. Bleeker's being unnecessarily elaborate.

D. 18, A. 20, L. lat. 44, L. transv. 12.

“The length of the head is contained four times and one-fourth in the total (without caudal), the height of the body twice and three-fourths; head nearly as deep as long; scales regularly arranged, firm, adherent, with the margins serrated and irregularly crenulated; abdominal and dorsal profiles equally convex; lower jaw slightly projecting beyond the upper; snout short, *maxillary extending nearly to below the middle of the orbit*. A narrow strip of teeth on the palatine and pterygoid bones, none on the verner; tongue with a median longitudinal toothed ridge. Opercles smooth. Gill rakers very fine and closely set, a little shorter than the eye. Eye as long as the snout, contained thrice and one-third in the length of the head. Ventral fin inserted below the posterior half of the dorsal fin, which occupies the middle of the distance between the end of the snout and the root of the caudal fin. There are thirteen abdominal scutes behind the base of the ventral fin. Top of the dorsal fin, a spot on the base of the anterior dorsal rays and the extremity of the caudal lobes, blackish. Amboyna.”

It is not unfrequently seen in Port Jackson, where it is known to the fishermen as the “herring,” and is considered quite equal in an edible point of view to the “*Maray*.” Some fishermen assure me that like the last species, *C. sundaica*, it is seen to pass the Sydney Heads in the winter season in enormous shoals, and that the two species are sometimes mingled together. I may add that some of the fishermen have been in the habit of looking upon them as the same species.

9. CLUPEA MOLUCCENSIS? Bleek.

Atlas Ichthyol. Clup. p. 107, Pl. 263, fig. 2.

Dr. Bleeker says that this Fish is common in the seas of the Moluccas and Sunda. I have never seen a specimen of it. Count Castlenau describes under this name in the Proc. Linn. Soc., N. S. Wales, Vol. 3, p. 395, a Fish of which he has seen

specimens in the Sydney Market, and also one specimen from Brisbane. It seems, however, to be very different in its deep and compressed form from the species to which Dr. Bleeker gives that name.

The Count's description is as follows:—

“The body is very compressed; height contained twice and one-third in the total length, without the caudal; head, three times and a half in the same; the lower jaw is larger than the upper one, and when the mouth is shut the opening is upwards; snout very short; maxillary very large, and extending further than the anterior margin of the eye; this is large, and only contained twice and a half in the length of the head; dorsal, with seventeen rays; caudal, very forked; anal, low, with eighteen rays, the ventrals are inserted a little behind the pectorals; mouth, very extensible; tongue smooth; the serrature of the belly extends higher than the pectorals; of a beautiful azurine blue on the back, the rest very silvery; head, gilt; fins, of a light yellow; the dorsal with its extremity, and a faint transverse band, black, seen in the sun there seems to be a longitudinal white stripe on the body between the blue and silvery.”

The proportions of the eye to the head given above would lead me to believe that this is the *Clupea Kunzei* of Dr. Bleeker, a species which Dr. Gunther does not recognise as distinct from *Moluccensis*, but which Dr. Bleeker himself regards and describes as very different. The great height of the body, however, given by Count Castlenau— $2\frac{1}{3}$ in the total length exclusive of the caudal fin,—precludes the possibility of its being *Kunzei*.

I have been unable to get information of any kind as to this fish.

10. CLUPEA TEMBANG. Bleek.

Atlas Ichthyol. Clup. p. 106, Pl. 266, fig. 6.

Clupea gibbosa of the same author.

The following is Dr. Gunther's description (Cat. Fish., Vol. 7, p. 426):—B. 6. D. 18. A. 18-19. L. lat. 45. L. transv. 12.

“The height of the body is a little more than the length of the head, which is one-fourth of the total (without caudal); head, longer than deep; scales, regularly arranged, rather firm and adherent, with the margin very indistinctly striated; abdominal and dorsal profiles nearly equally convex; lower jaw projecting beyond the upper; snout of moderate length, maxillary not extending to below the middle of the orbit; a narrow strip of minute and deciduous teeth on the palatine bones, none on the vomer; tongue with a very narrow median band of minute teeth; cheeks with very fine radiating striæ; opercles, smooth; gill rakers, fine and closely set, shorter than the eye; eye shorter than the snout, a little more than one-fourth of the length of the head; ventral fin inserted below the middle of the dorsal fin, the origin of which is considerably nearer to the end of the snout than to the root of the caudal fin. There are fourteen abdominal scutes behind the base of the ventral fin; back bluish, with dark longitudinal lines; sides silvery.”

This species has not much claim to be called Australian. I have seen a few young specimens from Port Darwin, and I procured in August, 1875, three specimens at Bramble Cay, under circumstances explained in page 351 of the 1st Volume of the Proceedings of this Society. Dr. Bleeker says that they are sometimes extremely numerous throughout the entire East Indian Archipelago, more particularly at Batavia, but though celebrated for their excellence, and much prized as an article of food by the Chinese and native inhabitants, they are seldom seen on the tables of Europeans. Tembang, I may add, is the Malay name.

11. CLUPEA NOVÆ-HOLLANDIÆ. (C. & V.)

Gunther Cat. Fish., Vol. 7, p. 431.

Meletta Novæ-Hollandiæ, Cuv. and Vol. XX., p. 376.

This and the two following species are the Australian representatives of the Sprat. They are mostly fresh water

Fishes. Dr. Gunther describes the species thus:—B. 8. D. 16. A. 16. L. lat. 48. L. transv. 11. Cœc. pyl. 14. Vert. 47.

“The length of the head is contained four times and one-third in the total (without caudal), the height of the body four times. Scales regularly arranged, firm, adherent, smooth. Lower jaw rather prominent, the maxillary narrow, extending a little beyond the front margin of the orbit. A small patch of distinct teeth anteriorly on the palatine bones; none on the pterygoid bones. A series of teeth along the median ridge of the tongue. Opercles, smooth; *sub-operculum*, narrow, tapering behind; *gill rakers* fine and closely set, half as long as the eye. Eye as long as the snout, which is of moderate extent, two-sevenths the length of the head. Ventral fin inserted below the anterior half of the dorsal fin, the origin of which is nearer to the end of the snout, than to the root of the caudal fin. There are fifteen abdominal scutes behind the base of the ventral fin, their spines much projecting. Silvery, dorsal and caudal fins brownish.”

This is a beautiful little fish, about five inches in length, and is well known as the “herring” in all the tributaries of the Hawkesbury, but I have not heard of it in any other of our East Coast rivers, and it is certainly never found in the Western rivers. Angling for this Fish is a favourite sport in some of the upper waters of the Nepean. It is of no great value as a food Fish.

12. CLUPEA VITTATA, Castelnau.

Meletta Novæ Hollandiæ, Castelnau, Proc. Zool. and Acclim. Soc., Victoria; Vol. 1. p. 189.

Count Castelnau described this species under the belief that it was the true *C. Novæ Hollandiæ*, and on discovering his mistake suggested the specific name *vittata*. He describes it thus:—“Height four and a half times in the total length; head five and a half in the same; eye as long as the snout, and contained three and a half times in the head; the lower jaw longer than the

upper, mouth extensible; no teeth on the palate; maxillary extending to below the front edge of the eye; body compressed; forty-six scales on the longitudinal line; sixteen rays to the dorsal; twenty to the anal; the caudal has nineteen rays with five short ones on each side; the pectoral fourteen rays. The height of the first ray of the dorsal is equal to the distance from the end of the snout to the anterior (? posterior) edge of the eye; the other rays go on decreasing as they extend backwards, and the last are only half the height of the first; the caudal is very strongly bifurcated, being twice as long on its sides, as at its centre; the ventrals are as long as the dorsal, and a little shorter than the pectorals. The general colour is of a light green, with a broad well-marked silvery streak on each side; the belly is white; the operculum and throat are silvery and iridescent; the dorsal and caudal are yellow, and the other fins translucent; the eye silvery.”

This fish, the Count tells us is at times abundant in the Melbourne Market, it is about four inches long, and is known as “*The Smelt.*” It is probably entirely a fresh-water species.

13. CLUPEA RICHMONDIA, *n. sp.*

I give this name to a species abundant in the Richmond River and believed by Count Castelnau to be identical with *C. Novæ-Hollandiæ*. It is however, evidently, a distinct species, agreeing with *Novæ-Hollandiæ* in the number of the fin rays, but very conspicuously different in having a very broad silvery stripe on the sides, margined above and below by a dark stripe. In size too it is inferior.

14. CLUPEA SCHLEGELII, Castelnau.

Meletta Schlegelii, Castelnau, Proc. Zool. and Acclim. Soc., Victoria
Vol. 2, p. 93.

Height of body three times and one third in the length without the caudal, or a little over three times and a half to the central

end of this fin. Head contained four times in the length (without caudal); eye twice and three-fourths in the head. The snout is considerably shorter than the diameter of the eye; the lower jaw much longer than the other; the maxillary extends to below the first-third of the eye; the cheeks and the two opercles are finely striated; the lower profile is rather more convex than the upper one; scales regularly arranged, rather firm; they are strongly striated with the margin finely crenulated; dorsal of nineteen rays, the end of this fin is at an equal distance from the snout and the end of the tail. The caudal is deeply forked, of sixteen long rays, with several shorter ones on each side, anal of 28 or 29 rays; the ventrals are small; the pectorals are nearly twice as long, of sixteen rays. The general colour is bright and silvery, with the back of a light purple; the anterior part of the head and fins are yellow; the operculum gilt. Length three inches."

The species comes from Port Darwin. The most distinctive character seems to be the number of the anal rays, I know no *Clupea* with such a number. Nothing seems to be known of its history.

15. SPRATELLOIDES DELICATULUS, Benn.

Gunth. Cat. Fish, Vol. 7, p. 464, *Clupea Macassariensis*, Bleek.
Atlas, Ichthyol. Clup., p. 96, pl. 264, fig. 3.

The following is Dr. Gunther's description of the species:—
" 'B. 6. D. 11. A. 9. S. lat. 35.' The height of the body is one-sixth, or rather more than one sixth of the total length (without caudal) the length of the head one-fourth. Snout rather pointed, longer than the orbit, with the lower jaw slightly projecting beyond the upper. Maxillary rather broad and extending to the vertical from the front margins of the orbit. Origin of the dorsal fin nearer to the end of the snout than to the root of the caudal, ventrals inserted below the posterior third of the dorsal fin. Back dark-coloured, sides and belly silvery, the two colours sharply defined."

In the second volume of the Proceedings of this Society, page 351 will be found an account of the large numbers of this Fish seen by the members of the "Chevert Expedition" at Darnley Island, in August 1875. There can be no doubt that it is a very delicate and delicious fish, and might be utilized to great advantage. It is found in most parts of the Indian Archipelago. Dr. Bleeker mentions that an allied species—*Spratelloides gracilis* is much used in Celebes in the manufacture of the "Red Fish," (*Ikan Merah*)—mentioned a few pages back, when treating of the genus *Engraulis*—and it forms a large article of export from Macassar.

16. *ETRUMEUS JACKSONIENSIS*, McLeay.

Proc. Linn. Soc., N.S. Wales, Vol. 3, p. 36, pl. 4, fig. 1.

This genus is readily distinguishable from the rest of the *Clupeidæ*, by the entire absence of compression or serration of the abdomen, and the position of the ventral fins quite behind the dorsal. The species is fully described by me, and figured in the Volume of our Proceedings above mentioned.

I have never seen but one specimen, caught by Mr. Masters, about fifteen months ago in the harbour. But I am told by some fishermen that it is one of those known to them as "*Maray*," and that it passes northwards every winter in enormous shoals. It is said also to be very much appreciated as food by the few who have had the opportunity of tasting it.

17. *ELOPS SAURUS*, Linn.

Gunth. Cat. Fish, Vol. 7, p. 470.

"B. 29-35. D. 23-24. A. 15-17. V. 14-18. L. lat. 108. L. transv. 13/15."

"The length of the head is one-fourth of the total length, (without caudal) and much more than the height of the body. Lower jaw scarcely projecting beyond the upper. Maxillary extending far behind the orbit, cheek covered by the dilated

posterior part of the suborbital ring. Uniform silvery.”
(*Gunther.*)

This very beautiful fish is only occasionally taken in Port Jackson. It is probably less rare farther north, as it is chiefly in tropical seas that it is found, and that in all parts of the world. Sir John Richardson gives a good figure of it in the *Voy. Ereb. and Terr.*, Fish, p. 59, pl. 36, fig. 3—5., under the name of *Elops machnata*. Dr. Bleeker says of it, that though the flesh is good, the fish is not in much request.

18. MEGALOPS CYPRINOIDES, Brouss.

Gunth. Cat. Fish, Vol. 7, p. 471.

“B. 23-26. D. 17-20. A. 24-27. L. lat. 37-42. Vert. 28/29.”

“Ventral fin inserted below the origin of the dorsal; maxillary extending to below, or even somewhat behind, the posterior part of the orbit. From the East Coast of Africa, to Polynesia and Australia; entering fresh waters. (*Gunther.*)”

This is a species of very wide range. It is found in the Hawkesbury, and I have specimens from Port Darwin. It is considered identical with *Megalops setipinnis* of Richardson, and the *Elops cuddinga* of Dr. Cantor, “*Fishes of Malacca*, p. 289.” The adult fish is about a foot in length, and Dr. Cantor says that notwithstanding their numerous fine bones they are valued for their flavour, and are rapidly multiplied and fattened for use in tanks.

19. CHANOS SALMONEUS, Bl.

Gunth. Cat. Fish., Vol. 7, p. 473.

“B. 4. D. 13-17. A. 9-10. L. lat. 85-88. L. transv. 13/16.
Vert. 19/26.”

“Uniform silvery.”

These are all the specific characters given by Dr. Gunther of this Fish, though it has synonyms without number. In fact the

species is very subject to variety, and it becomes consequently difficult to find good definitions. The genus, however, is very distinct and well defined. Count Castlenau has added the name of this Fish to his list of Port Jackson Fishes, but it certainly must be a very rare visitant. It is, however, common enough on the Northern Coasts, and I have had specimens from Fiji, always found in fresh water. This is the most prized of all the Herring tribe for the excellence of its flavour, and in many parts of India it is domesticated and kept in large tanks for the use of the wealthier inhabitants. Its length is about two feet. If a little of the enterprise exhibited in the efforts that have been made to introduce the Salmon into our rivers, was expended upon the cultivation of this Fish in our coast rivers north of the Clarence, the result, I venture to say, would be much more satisfactory.

In the foregoing pages I have enumerated all the species of *Clupeidæ* which I know, either of my own knowledge or on the authority of Count Castlenau, to have been found in Australian waters, but it must not be supposed that the list is likely to be complete or nearly so. The Fishes of the West Coast are very little known, and many discoveries are likely yet to be made on the Northern, but probably we may accept the above list as enumerating with some correctness the species of the Southern and Eastern Coasts.

Of the value of some of these Fishes in an economic point of view, I have only a very few remarks to make. It is certain that so far as the immediate vicinity of Sydney is concerned, the two species—*Clupea sagax* and *Clupea sundaica*—annually in the winter season pass the Heads, proceeding in a northerly direction in enormous shoals, and there is reason to believe that two other species—*Clupea hypselosoma* and *Etrumeus Jacksoniensis*—pass also in large shoals about the same period of the year. That these Fishes also are of great value as food, and that they might be

utilized to an almost unlimited extent in various ways, scarcely admits of question. The establishment, however, of a new industry, such as a Herring Fishery would be here, is always a difficult and costly thing, and not to be undertaken with the hope of immediate returns. The British Fishery Society, established about the end of last century, for the prosecution of the Herring Fishery in the North of Scotland, laboured for many years before the Fishery became a complete success, and they were for many years largely assisted by the Government with grants, bounties, &c. So it must be here, before much can be done; and until a liberal Government or a wealthy company undertake the task of establishing Fisheries on our shores, all we can attempt is to endeavour to make ourselves better acquainted with the history and habits of the finny tribes. It is most desirable that all those who have the opportunities, such as fishermen, masters of coasting vessels, &c., should make notes of *where* and *when* they came across shoals of fish—the *kind* of fish, of which a specimen or two should be put into spirits for identification—the *direction* in which the shoal is moving—the apparent extent of it—whether they are full or spent fish—and any other remarks occurring to the observer at the time. I shall be very glad to receive and register all such observations, which even if they are of no further use, will certainly help in the solution of two points—*where* and *how* to fish to the best advantage for the different species.

NOTES ON THE GENUS *Cypræa*.

BY JAMES C. COX, M.D., F.L.S., &c.

The various species of the genus *Cypræa* are, as a rule, well defined in their characters, but several which are found in our neighbouring waters vary sufficiently in shape and colouration to make it worth while to have these variations noted so as to

